eBird Best Practices II

Occupancy Modeling

The Cornell Lab of Ornithology

Occupancy models are used to estimate the true probability of a species occurring at a site while accounting for imperfect detection

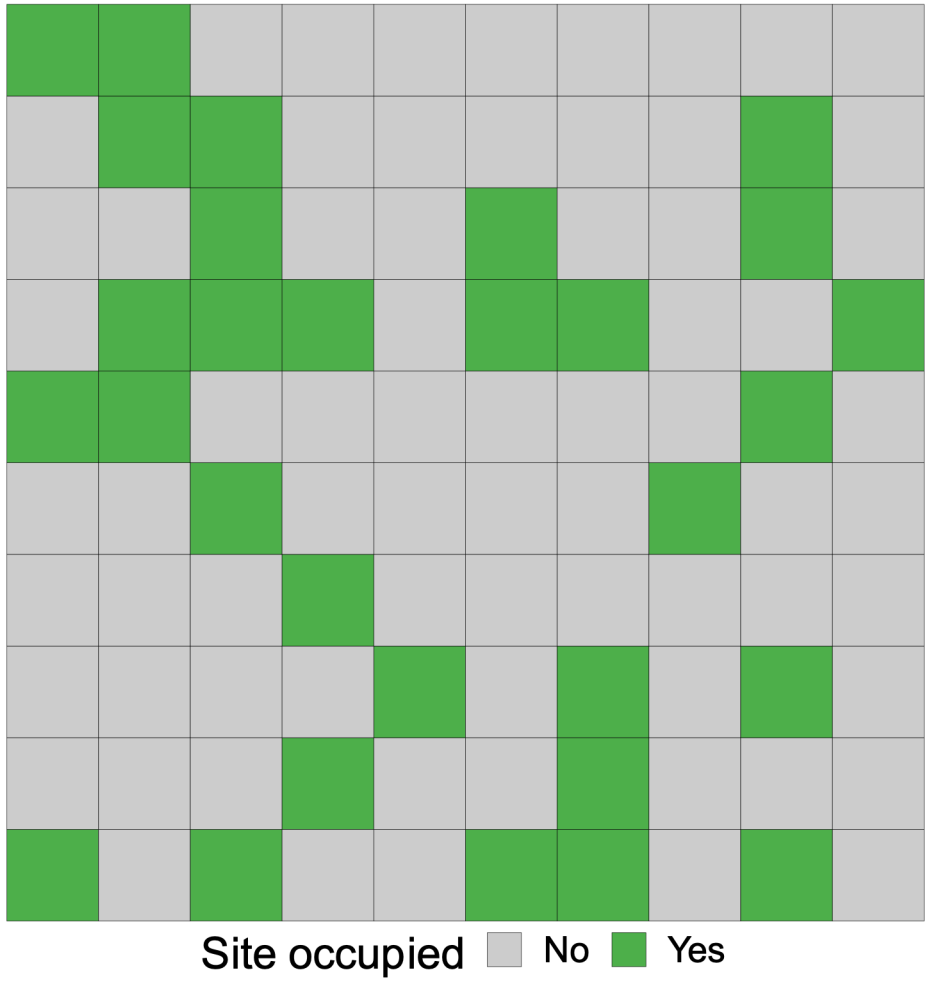
An observer recording a species at a site results from two processes

Ecological the species is present at that site

ψ = probability that the site is occupied

Observational the observer detected the species

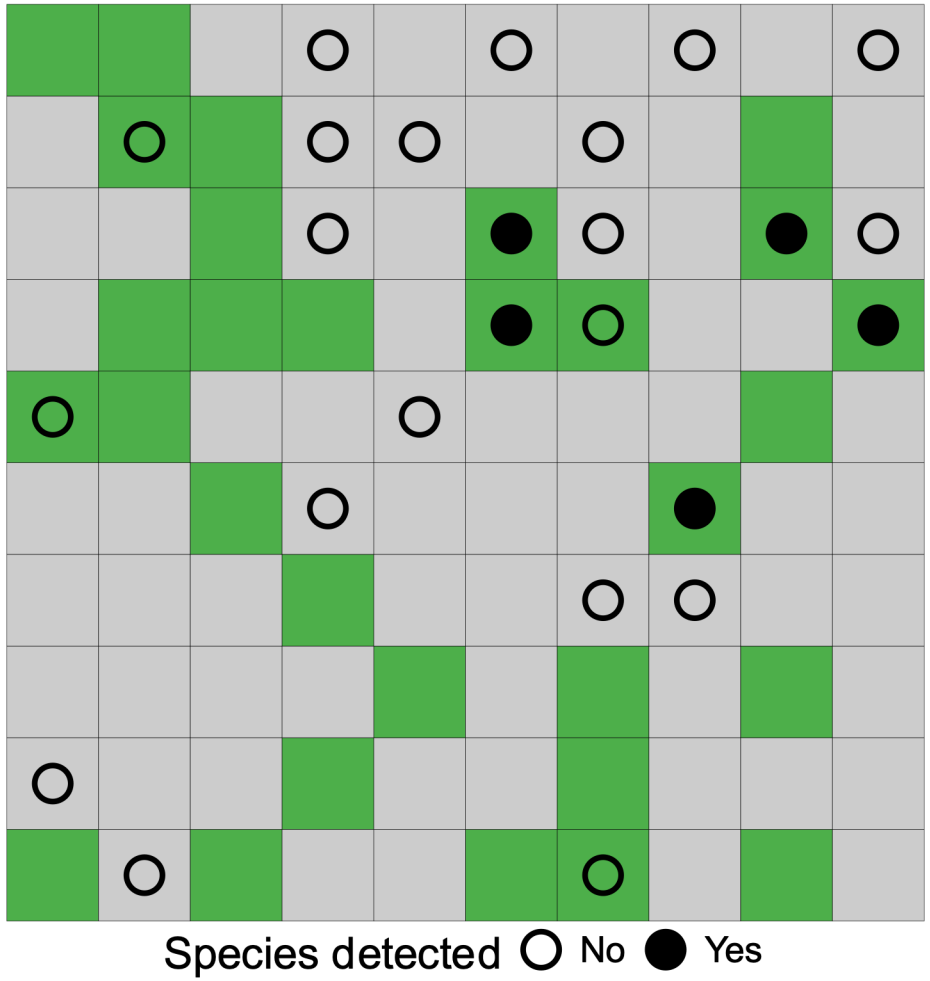
p = probability of detection, given that the site is occupied



Occupancy for

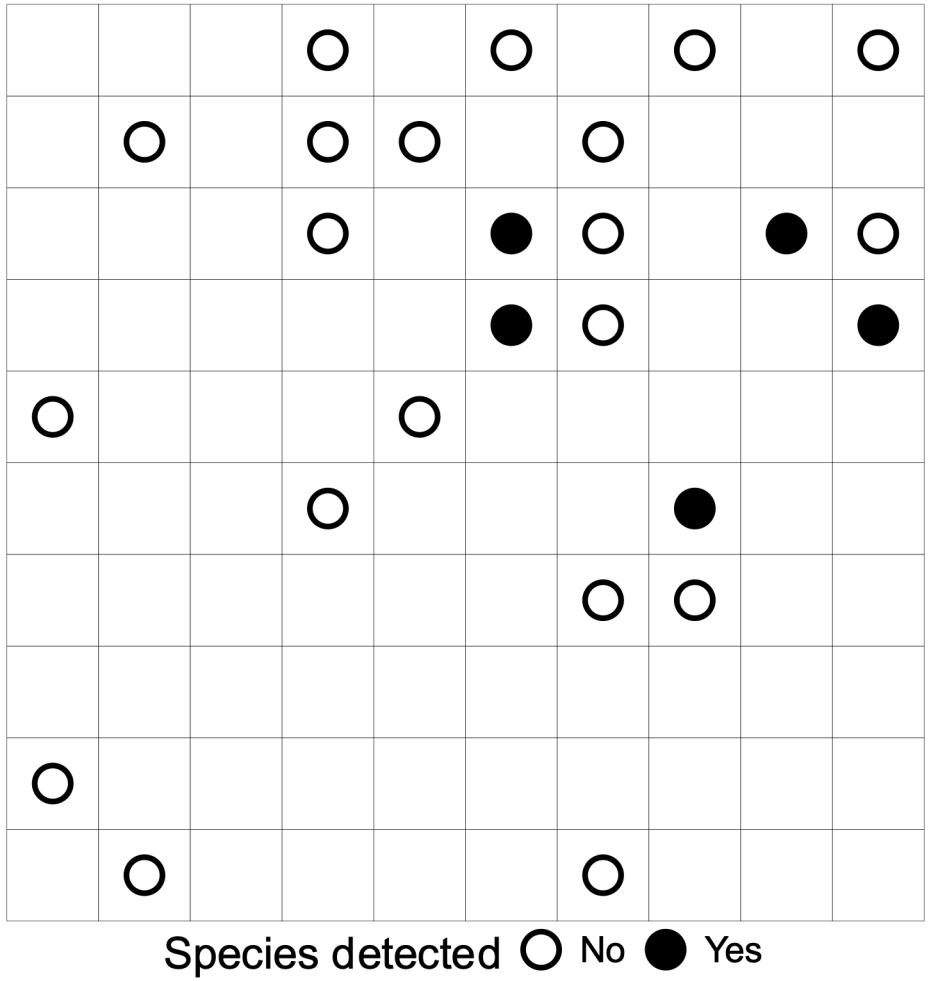
$$n = 100 \text{ sites}$$

$$\psi = \frac{30}{100} = 0.3$$



25 sites surveyed, non-detection can be due to:

- Species not present
- Species not detected



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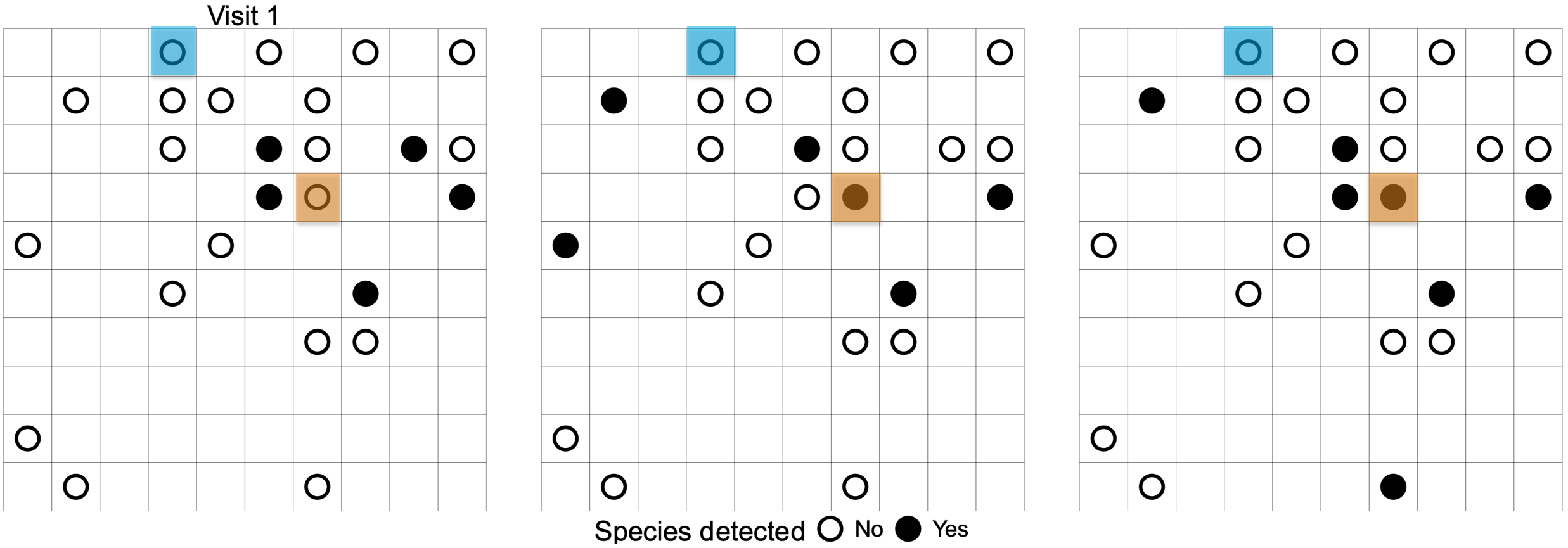
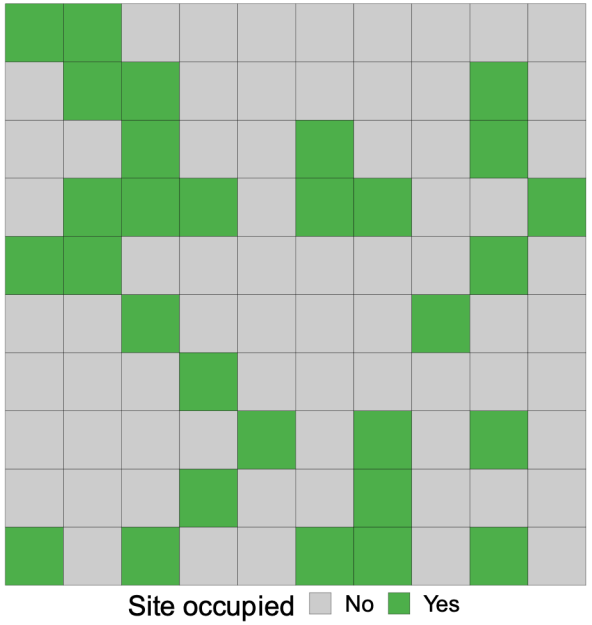
Repeat sampling can be used to estimate the detection probability p

0 1 1 0 0 0



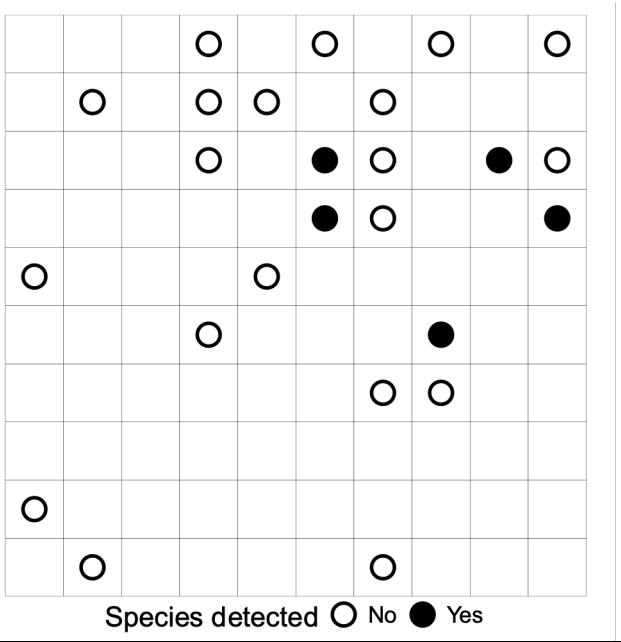
Repeat sampling can be used to estimate the detection probability p

	Sampling occasion							Sampling occasion						
Site 1	0	1	1	1	1	1	1	0	0	1	0	0	0	0
Site 2	1	1	1	1	1	1	1	1	0	0	0	0	0	1
Site 3	1	1	1	0	1	1	0	0	0	0	0	1	0	0
Site 4	1	1	1	1	1	1	1	0	0	0	1	0	0	0
Site 5	1	0	1	1	1	1	1	0	0	0	0	0	0	1
Site 6	1	1	1	1	0	1	1	0	0	0	1	0	0	0
Site 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Ecological process

→ what we want to know



Observation process

→ what we actually measure

Assumptions

- Repeated surveys occur during a period of **closure**, when there is no change in occupancy state
- There are **no false detections**
- Sites are **independent**
- The relationship between occupancy and detection probabilities and the covariates is **stationary**, i.e. constant across sites and visits